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Report No. 10490

PROJECT COMPLETION REPORT

KOREA

SECOND POWER PROJECT
(LOAN 2671-KO)

APRIL 3, 1992

Industry and Energy Operations Division
Country Department I
East Asia and Pacific Regional Office

CURRENCY EQUIVALENTS

Currency Unit - Won (W)

US$1.00 = W 860 (SAR)
= W 690 (Project Completion)

FISCAL YEAR

January 1 - December 31

UNITS AND EQUIVALENTS

1 meter (m)	=	3.28 feet (ft) = 100 centimeters (cm)
1 kilometer (km)	=	0.62 miles (mi)
1 kilogram (kg)	=	2.206 miles (mi)
1 ton (metric) (t = 1,000 kg)	=	1.100 short tons (sh. tons)
1 kilowatt (kW)	=	1,000 Watts (10^3 W)
1 Megawatt (MW)	=	1,000 kW (10^3 kW)
1 Gigawatt (GW)	=	1,000 MW (10^6 kW)
1 kilowatt-hour (kWh)	=	1,000 Watt hours
1 Gigawatt-hour (GWh)	=	1,000 Megawatt-hours (10^6 kWh)
1 kilocalorie (kcal)	=	3.968 British thermal units (Btu)
1 atmosphere (atm)	=	14.70 pounds per sq inch = 1.033 kg/sq cm

ABBREVIATIONS

EHV	Extra High Voltage
EPB	Economic Planning Board
EPGCC	Electric Power Group Coordination Council
ISWACO	Industrial Sites and Water Resources Development Corporation
KAERI	Korea Advanced Energy Research Institute
KDI	Korea Development Institute
KEMCO	Korea Energy Management Corporation
KEPCO	Korea Electric Power Corporation
KEPOS	Korea Electric Power Operating Service Company, Limited
KGC	Korea Gas Corporation
KHIC	Korea Heavy Industries and Construction Company
KMPC	Korea Mining Promotion Corporation
KNFC	Korea Nuclear Fuel Company, Limited
KOPEC	Korea Power Engineering Company, Limited
LNG	Liquified Natural Gas
LRMC	Long-Run Marginal Cost

THE WORLD BANK
Washington, D.C. 20433
U.S.A.

Office of Director-General
Operations Evaluation

April 3, 1992

MEMORANDUM TO THE EXECUTIVE DIRECTORS AND THE PRESIDENT

SUBJECT: Project Completion Report on Korea
Second Power Project (Loan 2671-KO)

Attached, for information, is a copy of a report entitled "Project Completion Report on Korea - Second Power Project (Loan 2671-KO)" prepared by the East Asia and Pacific Regional Office. No audit of this project has been made by the Operations Evaluation Department at this time.

Attachment

PROJECT COMPLETION REPORT

KOREA

SECOND POWER PROJECT
(LOAN 2671-KO)

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PROJECT COMPLETION REPORT

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SECOND POWER PROJECT
(LOAN 2671-KO)

Preface

This is the Project Completion Report (PCR) for the Second Power Project in Korea, for which Loan 2671-KO in the amount of US$230 million was approved on March 27, 1986. The loan was closed as scheduled on June 30, 1990. US$44.1 million of the loan amount was canceled in three steps, the final cancellation being on March 28, 1990. The remaining amount of US$185.9 million was fully disbursed with the final withdrawal of US$8.0 million on March 28, 1990.

The PCR was prepared by the Industry and Energy Operations Divisions, Department II of the Asia Regional Office (Preface, Evaluation Summary, Parts I and III), and the Borrower, Korea Electric Power Corporation (KEPCO) prepared Part II.

Preparation of the PCR was started in August 1990 and is based on, inter alia, the Staff Appraisal Report, legal documents, supervision and progress reports, correspondence files and a comprehensive data compilation provided by KEPCO.

PROJECT COMPLETION REPORT

KOREA

SECOND POWER PROJECT
(LOAN 2671-KO)

Evaluation Summary

Objectives

1. The main objective of the project was to support KEPCO's 1986-89 investment program of constructing additional transmission and distribution facilities to match its generation expansion program and meet the estimated demand growth reliably and efficiently. In addition, the project was to help implement important programs of end-use survey and load management, and assist in improving economic efficiency of resource utilization through improved investment planning techniques in the power subsector. Efforts at rationalizing KEPCO's tariff structure were to be continued in the context of variations in demand characteristics and cost of services prevailing at the time (Part I, para. 31.).

Implementation Experience

2. The project was expeditiously implemented and completed on schedule without encountering significant difficulties. Procurement arrangement required international competitive bidding (ICB) for all goods, except concrete poles, financed by the Bank loan. This was KEPCO's first exposure to ICB. KEPCO reports that the Bank's review and approval procedures caused some initial delays, but they were overcome and did not affect overall progress. KEPCO further reports that as a result of the use of ICB it was able to obtain better quality material and equipment at less cost since many Korean manufacturers improved their competitive standing, both in quality and price. A review by Bank staff showed that under ICB domestic suppliers were mostly the successful bidders and that their bids were generally lower, in some cases substantially lower, when compared to similar purchases using KEPCO's local bidding procedure (Part I, para. 5.1).

Results

3. The project was successfully completed on schedule and within budget, and it achieved its objectives. Except for a minor shortfall in high voltage circuits, the transmission and distribution targets set for the KEPCO 1986-89 investment program were significantly exceeded. The sector and institutional components were largely carried out as planned. KEPCO's financial performance over the 1986-89 period was generally satisfactory. The reevaluated internal financial rate of return was calculated to be 12 percent, the same as the SAR estimate. The SAR estimated the internal economic rate of return to be 15 percent based on the base demand case excluding consumer

surplus. The same value was obtained for the reevaluated rate of return (Part I, paras. 6.1-6.3).

Sustainability

4. Benefits from the project should be sustainable into the foreseeable future given the fact that (i) KEPCO's transmission and distribution facilities have been installed in accordance with strict design and construction standards and international practices and (ii) KEPCO has the technical and administrative skills to competently maintain and operate these facilities. The decline in KEPCO's system load factor and its impact on future investments was a cause for concern; however, implementation of a load management program and follow-up efforts should enable KEPCO to successfully deal with this problem (Part I, para. 7.1).

Findings and Lessons Learned

5. KEPCO's implementation of the project demonstrated its high level of technical expertise and outstanding operational efficiency. A future Bank lending operation involving KEPCO should focus on helping KEPCO achieve sectoral and institutional goals (Part I, para. 9.1).

6. KEPCO's implementation experience also showed that price and quality benefits can be realized by procuring equipment and material using competitive bidding procedures. This reinforces the validity of Bank insistence on competitive bidding (Part I, para. 9.1).

PROJECT COMPLETION REPORT

KOREA

SECOND POWER PROJECT
(LOAN 2671-KO)

PART I

1. Project Identity

Project Name:	Second Power Project
Loan No.:	Loan 2671-KO
RVP Unit:	Asia
Country:	Korea
Sector:	Energy
Subsector:	Electric Power

2. Background

2.1 The high oil prices in the 1970s dealt a heavy blow to Korea's energy intensive and oil import dependent economy. A severe recession and large burdensome balance-of-payment deficits were the result. The Government countered by adopting a strategy directed at diversifying energy sources and suppliers and readjusting the industrial structure of the economy to foster energy conservation and reduce the rate of growth of energy demand. This strategy achieved impressive results. Realizing that further gains could be achieved, the Government next shifted emphasis from diversification to improving the economic and institutional efficiency of the energy sector. The Sixth Five Year Plan implemented during 1987-91 emphasizes efficiency improvements in the energy sector.

2.2 The rationale of a Bank lending operation in the power sector was based on (i) the fact that investment in this sector constitutes 40% of the public investment program and consequently needs substantial external financing; (ii) it was felt that a few well directed changes in the investment program could significantly improve the pattern of resource allocation; (iii) consistent with its import liberalization policy, the Government had decided to permit overseas competition with domestic industries which had been protected from outside competition; and (iv) the Government was in the process of reexamining planning and policy issues in the context of its Sixth Development Plan, and the Bank's input at this stage could be of considerable benefit.

2.3 The Korea Electric Power Corporation (KEPCO), the borrower of the Bank loan, is a Government-owned corporation; it was the implementing agency for all components of the project. KEPCO was well qualified for this task having participated, since its inception in 1961, in a 20-fold increase in electricity generation, transmission and distribution.

3. Project Objective and Description

3.1 The main objective of the project was to support KEPCO's 1986-89 investment program of constructing additional transmission and distribution facilities to match its generation expansion program and meet the estimated demand growth reliably and efficiently. In addition, the project was to help implement important programs of end-use survey and load management, and assist in improving economic efficiency of resource utilization through improved investment planning techniques in the power subsector. Efforts at rationalizing KEPCO's tariff structure were to be continued in the context of variations in demand characteristics and cost of services prevailing at the time.

3.2 The project comprised:

(a) the transmission and distribution component of KEPCO's 1986-1989 investment program;

(b) technical assistance and engineering services; and

(c) a program for strengthening KEPCO's research center.

4. Project Design and Organization

4.1 The Bank opted for a lending operation in Korea's power sector because there was a need for funds and the timing was right. Thus, the project was conceived with the aim of providing Bank funds in a sector needing a substantial amount of external financing at the time, and also helping the Government resolve planning and policy issues which it was then reexamining. Furthermore, a report on energy sector issues in Korea had just been completed by the Bank. Project design was consistent with these aims. The project provided foreign exchange to help finance essential imports for expanding KEPCO's transmission and distribution facilities, and it included engineering services and technical assistance components which proved to be beneficial for KEPCO's operational and institutional development and efficiency.

4.2 Project preparation was thorough. The project components and the responsibilities for implementing them were clearly defined in the project documents and understood by all concerned. The decision to turn over to KEPCO these implementation responsibilities was well taken in view of its technical expertise and long experience in implementing power projects, and it was justified by results.

5. Project Implementation

5.1 The project was expeditiously implemented and completed on schedule without encountering any significant difficulties. Procurement arrangements for the project required international competitive bidding (ICB) for all goods financed by the Bank loan, except concrete poles which were procured through local competitive bidding. This was KEPCO's first exposure to ICB; KEPCO reports that the Bank's document review and approval procedures caused some

delays, but they were overcome and did not affect overall progress. KEPCO further reports that as a result of the use of ICB it was able to obtain better quality materials and equipment at less cost since many Korean manufacturers improved their competitive standing, both in quality and price. A review by Bank staff showed that under ICB domestic suppliers were mostly the successful bidders and that their bid prices were generally lower, in some cases significantly lower, when compared to similar purchases using KEPCO's local bidding procedures.

6. Project Results

6.1 The project was successfully completed within budget allocations, and it fully achieved its objectives. With regard to the project's physical components, actual results during the 1986-89 investment period significantly exceeded SAR forecasts except for a marginal shortfall in high voltage circuits (see Annex I). Other project results are discussed in the following paragraphs.

6.2 The internal economic and financial rates of return (IERR and IFRR) on KEPCO's 1986-89 investment program were reevaluated on the same basis as the SAR estimates. The results are tabulated below. Full details are given in Chapter 4 of Part III and Annex II.

Comparison of Economic and Financial Rates of Return

Rate of Return	SAR	Reevaluated
IERR - excluding consumer surplus	15%	15%
IFRR - 1986-89 investments, base demand case	12%	12%

6.3 The technical assistance, engineering study and research center equipment project components were carried out as planned with the following results.

(a) A standardization study for future 500 MW coal-fired power plants established the design basis, essential design details and technical specification for such future plants. The study laid the ground work for savings in such areas as design, construction, spare parts inventory and enhanced operating and maintenance efficiency.

(b) Two KEPCO staff members received training in the field of load research and management at the facilities of a French power company. The French company assigned two consultants to carry out a study of KEPCO's load regulating system and practices. The consultants focused on load regulation based on demand, but they noted that supply should not be overlooked because it could lead to substantial savings. The study provided (i) a review and analysis of tariff measures available to KEPCO for load regulation; (ii) a recommendation to carry out a cost benefit study before establishing a load management policy; helpful proposals were offered for the

existing situation; and (iii) a recommendation to develop a comprehensive and accurate data bank before proceeding with any extensive studies of KEPCO's electric power system; the main requirements are representative sampling using statistical studies and appropriate modern instrumentation and equipment.

(c) A wide range of testing, metering, analyzing and other scientific devices were purchased for the Electric Power Research and Development Center. Altogether, the equivalent of US$1.4 million was spent on essential research equipment for the center.

7. Project Sustainability

7.1 Benefits from the project should be sustainable into the foreseeable future given the fact that (i) KEPCO's transmission and distribution facilities have been installed in accordance with strict design and construction standards and international practices and (ii) KEPCO has the technical and administrative skills to competently maintain and operate these facilities. The decline in KEPCO's system load factor and its impact on future investments was a cause for concern; however, the implementation of a load management program and follow-up efforts should enable KEPCO to successfully deal with this problem.

8. Performance of the Bank

8.1 The Bank performed satisfactorily in the preparation of the project, and KEPCO's high level of technical competence left room only for technical advise during the implementation stage. The Bank's decision to finance a loan operation in Korea's power sector was well timed and chosen. First of all, it provided on opportunity to follow-up on the findings and recommendations of the comprehensive Bank-financed sector review during 1984-85, and in the context of the Sixth Development Plan, the Bank was able to establish a worthwhile planning and policy dialogue with the Government and KEPCO. Also of importance to the Goverrment and KEPCO at the time, the Bank loan provided much needed external finance toward the large sector investment program.

8.2 The Bank's supervision effort from 1988 onward dropped off sharply (Table 9B, Part III). This is understandable, however, considering that 70 percent of the transmission and distribution project components had already been completed by end-1987, and also that the project was proceeding without significant problems.

9. Performance of the Borrower

9.1 KEPCO is an efficient and well-managed utility with an energetic, qualified and motivated staff. This fact is reflected in its performance in executing the project which, both from a managerial and technical standpoint, was of a high quality.

10. Project Relationships

10.1 Bank staff established a good working relationship with KEPCO and government officials associated with the project. As far as could be observed, KEPCO remained on equally good terms with consultants and contractors throughout project implementation.

11. Consulting Services

11.1 KEPCO needed no consulting assistance for implementing the transmission and distribution components of the project. All of the consultants who undertook the technical assistance components performed their assignments professionally and competently.

12. Project Documentation and Data

12.1 The Staff Appraisal Report and the President's Report were comprehensive and well prepared. They gave a thorough account of the institutional and sectoral background of the project and its objectives. The legal documents provided the necessary legal framework for project implementation and agreements reached by the Bank with the Government and KEPCO.

12.2 Both the Bank's supervision reports and KEPCO's progress reports gave a comprehensive presentation of the project's implementation progress. However, the combination of KEPCO being required to submit annual progress reports and the Bank issuing only two supervision reports left a gap in up-to-date implementation information. This is not a serious matter when a project is efficiently and competently executed as in this case. Nevertheless, such infrequent reporting should be avoided as a matter of course. It should be a standard practice for Borrowers to submit quarterly progress reports during the active phase of project implementation.

12.3 Data for this PCR was obtained from documents, reports and correspondence in Bank files. A report prepared by KEPCO at the request of the Bank provided most of the essential data in Part III of the report.

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PART II

Project Objective

1. The objective of this project was to support KEPCO's program for the construction of additional transmission and distribution facilities to match the generation expansion program, meet demand growth; and, in addition, assist KEPCO in end-use survey and load management, improvement of planning techniques and rationalization of tariffs.

Project Description

2. The project consisted of the following parts:

- PART A: Carrying out the Transmission and Distribution Program and provision of equipment and materials.
- PART B: Carrying out a standardization study for 500-MW coal-fired thermal power stations and technical assistance for comprehensive load research and load management program.
- PART C: Improvement of KEPCO's research facilities and provision of equipment.

Implementation and Confirmation

3. All equipment and materials utilized for this project were procured on the basis of international competitive bidding and supplied by way of piece-meal contracts.

4. A total of 83 contracts were awarded as follows:

Description	No. of Contracts	Amount (US$ '000)	Remark
Part A	49	183,558	
Part B	2	948	
Part C	32	1,421	
TOTAL	83	185,927	

5. The nationality of suppliers are classified as follows:

Description	Nationality							
	Korea	USA	Japan	Taiwan	India	France	Europe	Total
Part A	33	-	8	2	3	1	2	49
Part B	1	-	-	-	-	-	-	2
Part C	-	17	6	-	-	-	9	32
TOTAL	34	17	14	2	3	2	11	83

6. KEPCO has acquired considerable experience in the improvement of engineering and project management capabilities and the purchase of high quality equipment at lower prices.

7. The performance of the consultants, contractors and suppliers was satisfactory. The project was, in every respect, a major success.

8. All details concerning the project and KEPCO's performance during the project implementation are contained in PART III; and we hereby confirms the adequacy and accuracy of all information in PART III.

Performance and Effectiveness

9. All material and equipment was supplied on time and KEPCO completed all programs on schedule.

10. The construction of the transmission and distribution lines and other facilities was satisfactorily completed on schedule.

11. No major problems were encountered, both consultants and contractors performed satisfactorily, and no major claims were made.

12. This was KEPCO's first experience in the procurement of localized items such as post-insulators, distribution wires, watthour meters, etc. through international competitive bidding, including Korean manufacturers under IBRD' procurement guidelines.

13. As a result, KEPCO was able to obtain better quality materials at lower prices, and many Korean manufacturers improved their competitive ability in the areas of both quality and price.

14. KEPCO has also gained considerable experience in improving cooperation with relevant departments, i.e., the technical engineering departments and the planning and controlling department.

15. Therefore, we were able to send progress reports every year and complete the projection in a more efficient and economical manner.

16. The IBRD's International Competitive Bidding procedures and required subsequent approvals for contract awards, etc., caused some delays, compared to the procurement, financed by the Korea Foreign Exchange Fund.

17. Despite these delays, KEPCO initially understood and adhered to be entire procedure; and with IBRD's help, KEPCO was able to rapidly proceed through the procurement process.

18. IBRD has made significant contributions through the introduction of an efficient procurement method which contributed to KEPCO's timely procurement on schedule.

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PART III

1. Related Bank Loans

Loan Tile	Purpose	Year of Approval	Status	Comments
Gojeong Power Project	Thermal power generation	1979	Completed successfully with 6 months delay and 16 percent cost underrun	Operating satisfactorily

2. Project Timetable

Item	Date planned	Date actual
Identification	04/85	04/14/85
Preparation	06/85	06/29/85
Appraisal Mission	07/85	06/29/85
Loan Negotiation	12/85	01/24/86
Board Approval	01/86	03/27/86
Loan Signature	-	07/14/86
Loan Effectiveness	06/86	09/04/86
Loan Closing	06/30/90	06/30/90
Project Completion	12/89	12/31/89

3. Loan Disbursements

3.1 The last disbursement was made on March 28, 1990. The final disbursement allocation by category are as follows:

Cumulative Estimated and Actual Disbursements
(US$ million)

IBRD fiscal year and semester	Actual disbursement	Appraisal estimate	Actual as percent of appraisal
1986			
June 30, 1986	-	1.5	0
1987			
December 31, 1986	17.8	22.5	79
June 30, 1987	67.5	45.0	150
1988			
December 31, 1987	88.5	67.5	131
June 30, 1988	140.8	90.0	156
1989			
December 31, 1988	167.3	125.0	134
June 30, 1989	167.3	160.0	105
1990			
December 31, 1989	177.9	195.0	91
June 30, 1990	185.9 /a	230.0	81

/a Total disbursed amount.

	Category		Disbursements (US$)
1.	Equipment and materials for Parts Parts A and C of the Project (except concrete poles)		152,779,179.46
2.	Concrete poles		32,169,150.08
3.	Consultancy services		900,468.14
4.	Technical Assistance (other than in Category 3 above)		47,797.53
	Special Account		30,180.50 /a
	Total Disbursement		185,926,775.71
	Cancellations:		
	On November 28, 1988	$35,850,000.00	
	On November 8, 1989	7,676,000.00	
	On March 28, 1990	547,224.29	44,073,224.29
	Original Loan Amount		230,000,000.00

/a This amount represents the exchange rate fluctuation for transactions made under the Special Account.

4. Project Implementation

Implementation goals and actual accomplishments are compared in Annex I.

5. Project Cost and Financing

A. Comparison of SAR and Final Project Cost
(US$ million)

Item	SAR Estimate			Final Cost		
	Local	Foreign	Total	Local	Foreign	Total
Transmission lines	513.4	198.7	712.1	508.0	208.8	716.8
Substations	252.9	257.9	510.8	257.2	264.3	521.5
Distribution	992.8	360.1	1,352.8	1,439.5	515.7	1,955.2
Research	2.0	5.0	7.0	0.8	4.5	5.3
Engineering	0.9	0.1	1.0	0.86	0.04	0.9
Technical assistance	0.9	0.1	1.0	0.5	0.1	0.6
Total Base Cost	1,762.9	821.9	2,584.8	2,206.9	993.4	3,200.3
Physical contingencies	72.1	43.1	115.1			
Price contingencies	205.4	162.1	368.1			
Total Project Cost	2,040.4	1,027.6	3,068.0			
Interest during construction	-	2.6/a	2.6	36	-	36
Total Financing	2,040.4	1,030.2	3,070.6/b	2,210.5	993.4	3,203.9

/a Capitalized interest during construction, applicable only to project components whose construction periods exceeds one year.

/b Includes taxes and duties in the amount of US$388 million.

B. Project Financing
(US$ million)

	Estimated	% of total	Actual	% of Total
Internal cash generation	1,462.0	48	2,812.8	87.8
IBRD loan	230.0	7	185.9	5.8
Other borrowing	1,378.6	45	205.2	6.4
Total Financing	3,070.6	100	3,203.9	100.0

6. Project Results

A. Overall Project Results

6.1 The technical assistance was carried out as planned. Annex 1 shows a comparison of the actual project results with the original targets for the transmission and distribution components of the project.

B. Economic Rate of Return

6.2 The internal economic rate of return (IERR) was reevaluated on the basis of the incremental costs and benefit streams associated with the 1986-89 investment program. An IERR of 15 percent was calculated compared to the 15 percent estimated at project appraisal. The details and basis for the reevaluation are given in Annex II, page 1 and Table 1.

6.3 The SAR considers the above IERR as being based only on the "direct" benefit of energy consumption and not including the effect of the indirect benefits represented by the consumer surplus. The consumer surplus was estimated by means of the demand functions developed by the research center for various consumer groups. Including the 26-28 percent of direct benefits weighted coverage determined at project appraisal the reevaluated, like the SAR value, is 19 percent.

C. Financial Results

6.4 The internal financial rate of return (IFRR) for the 1986-89 investment program was calculated by including taxes and duties with input costs and excluding sales taxes from revenues. The reevaluated IFRR is calculated to be 12 percent compared to the 12 percent SAR estimate.

6.5 KEPCO's key financial performance indicators for the 1986-89 period are compared with the SAR forecast in the following table. The financial statements over the same period are compared with the SAR in Annex III, Tables 1, 2 and 3.

Table 6.1: KEPCO'S FINANCIAL PERFORMANCE

Fiscal year ending Dec. 31	1986		1987		1988		1989	
	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast
Sales (GWh)	56,310	54,626	64,169	59,160	74,318	64,130	82,192	69,452
Average revenue per kWh (Won)	64.54	68.18	62.15	71.93	59.15	75.89	55.20	80.06
Operating revenues (Bln Won)	3,649	3,727	4,006	4,259	4,421	4,872	4,568	5,565
Operating expenses (Bln Won)	2,385	2,919	2,593	3,431	3,193	3,830	3,632	4,287
Operating income (Bln Won)	1,264	808	1,413	828	1,228	1,042	936	1,278
Rate of return								
- Base I (%) /a	11.6	7	12.5	7	10.7	8	8.1	9
- Base II /b	16.3	10	16.1	9	13.3	9	9.6	10
Operating ratio (%)	66	78	65	81	72	79	80	77
Current ratio (%) /c	48	45	49	43	80	51	93	60
Debt/equity ratio (%) /d	63/37	57/43	58/42	52/48	51/49	47/53	46/54	39/61
Net fixed assets/debt (times) /e	1.5	1.7	1.6	1.9	2.0	2.1	2.1	2.5
Self-financing ratio (%) /f	44.3	-0.2	38.2	1.0	60.0	0.0	78.1	41.1
Debt service coverage ratio (times)	1.2	1.0	1.5	1.0	2.0	1.0	2.9	1.3
Interest coverage ratio (times)	1.7	1.3	2.1	1.1	3.7	1.4	3.8	2.1

/a On average revalued net fixed assets in operation less consumers' contributions, plus works in progress and provision for working capital.

/b On average revalued net fixed assets less consumers' contributions.

/c Current assets as percentage of current liabilities.

/d Including other liabilities (such as provisions for self-insurance severance pay, assets retirement) as part of debt.

/e Total net fixed assets divided by long-term debt and other liabilities.

/f After deducting increases in working capital (less cash).

7. Status of Covenants

Section	Covenant	Current Status
Loan Agreement		
3.03	To furnish the Bank with annual Technical Progress Reports	Satisfactory
4.04	To take out and maintain insurance against all possible risks	Satisfactory
4.05	To furnish the Bank with annual reports	Satisfactory
4.06	To establish a permanent demand forecasting committee not later than 12/13/86.	Satisfactory
5.02	(a) To reach an annual return of not less than 9 percent for 1986 (b) To review financial forecast 3 months before start of fiscal year.	Satisfactory
5.03	To not incur debt more than 1.0 times the estimated debt service requirements for 1986.	Satisfactory
5.04	To prepare a 10-year financing and investment plan prior to 12/31/86	Completed
Guarantee Agreement		
3.01	Same as section 4.06 of the Loan Agreement	Completed
3.02	Same as section 5.02 of the Loan Agreement	Satisfactory

8. Use of Bank Resources

A. Staff Inputs

8.1 Staff inputs in carrying out the various tasks through project cylce from preparation in 1985 to completion in 1990 are summarized as follows:

Task	FY85	FY86	FY87	FY88	FY89	FY90	F791	Total
Preappraisal	16.5							16.5
Appraisal	1.7	38.1						39.8
Negotiations		9.4						9.4
Lending Development			.3					.3
Loan Processing	2.2	18.7						20.9
Supervision		4.2	14.9	1.6	2.5	1.9	.3	25.4
Project Completion Report							1.1	1.1
Advisory Review		.7						.7
TOTAL	20.4	71.	15.8	1.6	2.5	1.9	1.4	114.7

B. Mission

Stage of Project Cycle	Month/ year	No. of persons	Days in field	Speciali- zation /a	Performance rating	Type of problems/c
Through appraisal	04/85	3	13	PA, EC, EN	-	-
Identification	07/85	5	22	PA, EC, EN		
Appraisal				FA, CON		
Supervision						
1.	02/87	2	9	EC, CON	1	OS
2.	07/88	1	5	EC, EN	1	OS

/a PA = Procurement Adviser, EC = Economist, EN = Engineer.

/b 1 = No or minor problems.

/c OS = Overall Status.

PROJECT COMPLETION REPORT

KOREA

SECOND POWER PROJECT
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Comparison of Planned and Actual Transmission and Distribution Facilities

	1986		1987		1988		1989		Total	
	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual
Transmission Facilities (ckm)										
345 kv	534	956	535	114	180	186	150	12	1,400	1,267
154 kv	520	425	500	493	394	356	375	485	1,789	1,759
66 & 22 kv	-	118	-32	-41	-	50	-100	183	-132	392
Total	1,476	841	582	987	574	492	425	314	3,057	2,634
Substation Facilities (MVA)										
345 kv	2,333	1,833	1,677	1,001	1,000	2,333	500	1,500	6,500	5,667
154 kv	1,600	1,808	1,360	2,136	1,400	2,070	1,400	1,400	5,760	8,262
6 & 22 kv	-100	225	-71	132	-76	-50	-297	-50	17	186
Total	3,833	3,416	2,966	3,269	2,324	4,293	2,850	2,765	11,973	13,743
Distribution Facilities										
Route Length (ckm)	6,588	8,354	5,029	9,185	5,156	14,465	5,109	2,604	21,882	34,608
Transformers (MVA)	836	1,187	791	256	824	1,592	862	1,629	3,313	5,264

Units:

ckm = circuit kilometer
kv = kilovolt
MVA = megavolt-ampere

PROJECT COMPLETION REPORT

KOREA

ANNEX II
Table I

SECOND POWER PROJECT
(LOAN 2671-KO)

Reevaluation of the Internal Economic Rate of Return

	Investment costs(US$ mln)				Operations and maintenance costs(US$ mln)									
	Generation (1)	Transmission (2)	Distribution (3)	Total (4)	Generation (5)	Transmission (6)	Distribution (7)	Other (8)	Total (9)	Fual costs (US$ mln) (10)	Total costs 4+9+10= (11)	Energy sales (GWh) (12)	Sales revenue (US$ mln) (13)	Net benefits 13-11= (14)
1978	79.14			79.14							79.14			-79.14
1979	239.32			239.32							239.32			- 239.32
1980	380.07			380.07							380.07			- 380.07
1981	626.34			626.34							626.34			- 626.34
1982	856.80			856.80							856.80			- 856.80
1983	934.08			934.08							934.08			- 934.08
1984	858.69			858.69							858.69			- 858.69
1985	710.65			710.65							710.65			- 710.65
1986	491.44	294.90	349.39	1,135.73	64.45	30.25	74.14	73.01	241.85	87.91	1,465.43	14,068	1,207.74	- 257.75
1987	261.02	312.03	412.00	985.05	145.61	47.95	118.68	157.87	470.11	139.31	1,594.47	21,896	1,929.69	335.22
1988	180.54	296.30	542.56	1,019.40	202.47	58.30	146.51	187.31	594.59	165.00	1,778.99	25,347	2,326.35	547.36
1989	166.79	354.84	680.54	1,202.17	290.38	97.38	207.65	236.84	832.25	192.54	2,226.96	30,718	2,823.60	596.64
1990					270.65	101.94	224.66	230.26	827.51	202.61	1,030.12	32,989	2,803.74	1,773.62
1991					279.17	105.40	232.28	238.08	854.93	194.00	1,048.93	34,109	2,813.65	1,764.72
1992					279.93	105.55	232.62	238.43	856.53	194.53	1,051.06	34,159	2,817.78	1,766.72
1993					279.17	105.26	231.99	237.78	854.20	194.00	1,048.20	34,066	2,810.10	1,761.90
1994					279.17	105.26	231.99	237.78	854.20	194.00	1,048.20	34,066	2,810.10	1,761.90
1995					279.17	105.26	231.99	237.78	854.20	194.00	1,048.20	34,066	2,810.10	1,761.90
1996					283.63	106.94	235.69	241.58	867.84	197.10	1,064.94	34,610	2,854.98	1,790.04
1997					282.84	106.65	235.04	240.91	865.44	196.56	1,062.00	34,514	2,847.06	1,785.06
1998					282.84	106.65	235.04	240.91	865.44	196.56	1,062.00	34,514	2,847.06	1,785.06
1999					282.84	106.65	235.04	240.91	865.44	196.56	1,062.00	34,514	2,847.06	1,785.06
2000					283.63	106.94	235.69	241.58	867.84	197.10	1,064.94	34,610	2,854.98	1,790.04
2001					282.84	106.65	235.04	240.91	865.44	196.56	1,062.00	34,514	2,847.06	1,785.06
2002					286.52	108.03	238.09	244.03	876.67	199.11	1,075.78	34,962	2,884.02	1,808.24
2003					286.52	108.03	238.09	244.03	876.67	199.11	1,075.78	34,962	2,884.02	1,808.24
2004					287.30	108.33	238.74	244.70	879.07	199.66	1,078.73	35,058	2,891.93	1,813.20
2005					286.52	108.03	238.09	244.03	876.67	199.11	1,075.78	34,962	2,884.02	1,808.24
2006					286.52	108.03	238.09	244.03	876.67	199.11	1,075.78	34,962	2,884.02	1,808.24
2007					286.52	108.03	238.09	244.03	876.67	199.11	1,075.78	34,962	2,884.02	1,808.24
2008					287.30	108.33	238.74	244.70	879.07	199.66	1,078.73	35,058	2,891.93	1,813.20
2009					286.52	108.03	238.09	244.03	876.67	199.11	1,075.78	34,962	2,884.02	1,808.24
2010					273.32	103.50	228.09	233.79	838.70	191.05	1,029.75	33,494	2,762.92	1,733.17
2011					183.33	71.92	158.51	162.47	576.23	135.02	711.25	23,276	1,920.04	1,208.79
2012					107.89	43.61	96.11	98.51	346.12	84.98	431.10	14,113	1,164.18	733.08
2013					73.42	29.99	66.10	67.75	237.26	59.58	296.84	9,706	800.65	503.81
2014					32.97	13.47	29.68	30.43	106.55	26.76	133.31	4,359	359.57	226.26

IERR= 15.439 %

PROJECT COMPLETION REPORT

KOREA

SECOND POWER PROJECT
(LOAN 1671-KO)

Reevaluation of the Internal Economic Rate of Return
Main Assumptions and Basis

General

Cost and benefit figures contained in Table 1 of this Annex correspond with the actual during the period 1986-89 and the "base case" after 1990 where calculation of electricity benefits and O&M costs is predicted on the "base scenario" of the load forecasts and consumer surplus is not included in the stream of benefits.

All costs and benefits are expressed in 1990 constant dollars.

Investment Costs

Generation investment costs are for the projects commissioned during the period 1986-89 investment.

Operations and Maintenance Costs

Operation and maintenance costs are based on the actual cost figures in 1986-89. Fuel costs for 1986-89 are actual and for 1990 onwards were calculated by planned net generation and estimated fuel costs per KWh which takes account of the purchase price of the nuclear fuel as well as the costs involved in the conversion, enrichment and fabrication. Disposal costs of the fuel are included in generation operation costs.

Energy Sales and Revenues

The incremental energy sales and revenues for 1986-89 are based on the actual figures. Incremental energy generation for 1990 onwards was produced by simulating operations planning model. Incremental energy sales were calculated by adjusting the incremental energy generation for T&D losses and auxiliary energy consumption. Average price of electricity for 1990 onwards was assumed to remain, in real time, at its 1990 level.

PROJECT COMPLETION REPORT

KOREA

ANNEX II
Table 2

SECOND POWER PROJECT
(LOAN 2671-KO)

Reevaluation of the Internal Financial Rate of Return

	Investment costs(US$ mln)				Operations and maintenance costs(US$ mln)					Fual costs (US$ mln) (10)	Total costs 4+9+10= (11)	Energy sales (GWh) (12)	Sales revenue (US$ mln) (13)	Net benefits 13-11= (14)
	Gene-ation (1)	Trans-mission (2)	Distri-bution (3)	Total (4)	Gene-ation (5)	Trans-mission (6)	Distri-bution (7)	Other (8)	Total (9)					
1978	79.14			79.14							79.14			-79.14
1979	239.71			239.71							239.71			- 239.71
1980	380.50			380.50							380.50			- 380.50
1981	631.11			631.11							631.11			- 631.11
1982	876.16			876.16							876.16			- 876.16
1983	965.79			965.79							965.79			- 965.79
1984	896.52			896.52							896.52			- 896.52
1985	763.59			763.59							763.59			- 763.59
1986	547.03	314.63	367.82	1,229.48	64.90	30.39	74.28	125.91	295.48	87.91	1,612.87	14,068	1,098.01	- 514.86
1987	284.70	330.64	431.45	1,046.79	146.31	48.39	118.90	234.51	548.11	139.31	1,734.21	21,896	1,754.31	20.10
1988	196.03	315.20	564.26	1,075.49	203.54	58.80	146.76	296.05	705.15	165.00	1,945.64	25,347	2,114.95	169.31
1989	172.75	371.83	700.48	1,245.06	292.34	97.99	208.27	432.82	1,031.42	192.54	2,469.02	30,718	2,566.80	97.78
1990					272.75	103.26	225.31	366.84	968.16	202.61	1,170.77	32,989	2,548.73	1,377.96
1991					281.34	106.76	232.96	379.29	1,000.35	194.00	1,194.35	34,109	2,557.83	1,363.48
1992					281.11	106.92	233.31	379.85	1,001.19	194.53	1,195.72	34,159	2,561.58	1,365.87
1993					281.34	106.63	232.67	378.81	999.45	194.00	1,193.45	34,066	2,554.61	1,361.16
1994					281.34	106.63	232.67	378.81	999.45	194.00	1,193.45	34,066	2,554.61	1,361.16
1995					281.34	106.63	232.67	378.81	999.45	194.00	1,193.45	34,066	2,554.61	1,361.16
1996					285.84	108.33	236.39	384.86	1,015.42	197.10	1,212.52	34,610	2,481.88	1,382.88
1997					285.05	108.03	235.73	383.80	1,012.61	196.56	1,209.17	34,514	2,595.40	1,379.04
1998					285.05	108.03	235.73	383.80	1,012.61	196.56	1,209.17	34,514	2,588.20	1,379.04
1999					285.05	108.03	235.73	383.80	1,012.61	196.56	1,209.17	34,514	2,588.20	1,379.04
2000					285.84	108.33	236.39	384.86	1,015.42	197.10	1,212.52	34,610	2,588.20	1,382.88
2001					285.05	108.03	235.73	383.80	1,012.61	196.56	1,209.17	34,514	2,595.40	1,379.04
2002					288.75	109.43	238.79	388.78	1,025.75	199.11	1,224.86	34,962	2,588.20	1,396.94
2003					288.75	109.43	238.79	388.78	1,025.75	199.11	1,224.86	34,962	2,621.80	1,396.94
2004					289.54	109.73	239.45	389.84	1,028.56	199.66	1,228.22	35,058	2,621.80	1,400.77
2005					288.75	109.43	238.79	388.78	1,025.75	199.11	1,224.86	34,962	2,629.00	1,396.94
2006					288.75	109.43	238.79	388.78	1,025.75	199.11	1,224.86	34,962	2,621.80	1,396.94
2007					288.75	109.43	238.79	388.78	1,025.75	199.11	1,224.86	34,962	2,621.80	1,396.94
2008					289.54	109.73	239.45	389.84	1,028.56	199.66	1,228.22	35,058	2,629.00	1,400.77
2009					288.75	109.43	238.79	388.78	1,025.75	199.11	1,224.86	34,962	2,621.80	1,396.94
2010					275.46	104.84	228.76	372.45	981.51	191.05	1,172.56	33,494	2,511.72	1,339.15
2011					184.82	72.85	158.98	258.83	675.48	135.02	810.50	23,276	1,745.47	934.97
2012					108.79	44.17	96.39	156.94	406.29	84.98	491.27	14,113	1,058.33	567.07
2013					74.04	30.38	66.29	107.93	278.64	59.58	338.22	9,706	727.85	389.63
2014					33.25	13.64	29.77	48.47	125.14	26.76	151.89	4,359	326.88	174.99

IFRR= 11.911 %

PROJECT COMPLETION REPORT

KOREA

SECOND POWER PROJECT
(LOAN 2671-KO)

Reevaluation of the Internal Economic Rate of Return
Main Assumptions and Basis

General

Costs and benefit figures contained in Table 2 of this Annex correspond with the actual during the period 1986-89 and the "base case" after 1990 where calculation of electricity benefits and O&M costs is predicted on the "base scenario" of the load forecast.

All cost and benefits are expressed by including taxes and duties with input costs and excluding sales taxes from revenues in 1990 constant dollars.

Operations and Maintenance Costs

Operation and maintenance costs are based on the actual cost figures in 1986-89. Fuel costs for 1986-89 are actual and for 1990 onwards were calculated by planned net generation and estimation fuel costs per KWh which takes account of the purchase price of the nuclear fuel as well as the costs involved in the conversion, enrichment and fabrication. Disposal costs of the fuel are included in generation operation costs.

Energy Sales and Revenues

The incremental energy sales and revenues for 1986-89 are based on the actual figures. Incremental energy generation for 1990 onwards was produced by simulating operations planning model. Incremental energy sales were calculated by adjusting the incremental energy generation for T&D losses and auxiliary energy consumption. Average price of electricity for 1990 onwards was assumed to remain, in real time, at its 1990 level.

ANNEX III
Table 1

PROJECT COMPLETION REPORT

KOREA

SECOND POWER PROJECT
(LOAN 2671-KO)

Income Statements
(Billion Won)

Fiscal Year	1986		1987		1988		1989	
	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual
Energy Sales (GWh)	54,626	56,310	59,160	64,169	64,130	74,318	69,452	82.19
Sales increase (%)	8.00	11.0	8.30	14.0	8.40	15.8	8.30	10.6
Ave. tariff Won/kWh	68.18	64.54	71.93	62.15	75.89	59.15	80.06	56.20
Ave. price inc (%)	1.13	-4.03	5.50	-3.70	5.50	-4.83	5.50	-6.68
Operating revenues								
Energy revenue	3,724	3,634	4,255	3,988	4,866	4,396	5,560	4,537
Other oper. rev.	3.00	15	4.00	18	5.00	25	5.00	31
Subtotal	3,727	3,649	4,259	4,006	4,871	4,421	5,565	4,568
Operating expenses								
Fuel/bulk power	1,278	798	1,490	758	1,543	1,048	1,593	1,018
Power purchased	114	71	115	108	138	83	161	102
Personnel expense	221	261	248	293	275	315	306	444
Repair/maintenance	135	130	172	171	202	212	234	285
Depreciation	705	627	888	697	1,046	832	1,217	922
Taxes	112	174	105	173	145	225	219	343
Other	354	324	415	393	481	478	557	518
Subtotal	2,919	2,385	3,431	2,593	3,830	3,193	4,287	3,632
Operating income	808	1,264	828	1,413	1,041	1,228	1,278	936
Non-oper income (net)	-153	-499	-156	-505	-152	-2	-32	104
Net income before interest	-655	765	672	908	889	1,226	1,246	1,040
Total interest	655	620	724	540	745	408	691	307
less: I.D.C.	141	178	127	113	118	73	86	33
Interest to operation	513	442	597	427	627	335	604	274
Net income	142	323	75	481	262	891	641	766
Rate base (revalued)	7,863	7,755	9,733	8,754	11,078	9,259	12,347	9,765
Rate of return (%)	10	16.3	9	16.1	9	13.3	10	9.6
Operating ratio (%)	78	66	81	65	79	72	77	80

/a Average revalued net fixed assets in services, less consumers' contributions in aid of construction.

ANNEX III
Table 2

PROJECT COMPLETION REPORT

KOREA

SECOND POWER PROJECT
(LOAN 2671-KO)

Balance Sheets
(Billion Won)

Fiscal Year	1986 Plan	1986 Actual	1987 Plan	1987 Actual	1988 Plan	1988 Actual	1989 Plan	1989 Actual
ASSETS								
Fixed Assets								
Plant in service	13,604	12,407	16,186	13,540	18,906	15,031	21,785	16,394
less: Accum. depreciatio	4,227	3,989	5,324	4,696	6,624	5,553	8,131	6,487
Operating plant	9,377	8,418	10,862	8,844	12,282	9,478	13,654	9,907
Work in progress	2,591	2,159	2,264	1,967	1,574	1,289	807	987
Total fixed assets	11,968	10,577	13,126	10,811	13,858	10,767	14,461	10,894
Nuclear fuel	483	451	575	491	682	592	775	628
Current assets								
Cash and bank	167	181	223	137	256	206	291	407
Consumer acct/recv.	285	308	326	335	373	408	426	419
Inventories	223	186	248	210	278	201	312	213
Other	105	63	110	46	115	37	121	42
Total current assets	780	738	907	728	1,023	852	1,151	1,081
Other assets /a	768	804	630	536	496	372	459	419
TOTAL ASSETS	13,999	12,570	15,238	12,566	16,057	12,584	16,846	13,022
EQUITY AND LIABILITIES								
Equity								
Paid-in capital	1,603	3,042	1,603	3,042	1,603	3,042	1,603	3,042
Retained earnings	1,066	1,275	1,141	1,761	1,403	2,629	2,045	3,311
Revaluation surplus	2,290	48	3,123	49	4,010	51	4,804	54
Consumers contribution	311	306	389	391	480	497	593	577
Total equity	5,270	4,671	6,256	5,243	7,497	6,219	9,035	6,984
Long term debt (LtD)	7,683	7,456	7,737	6,788	7,106	5,208	6,117	5,032
Less: Current portion	1,308	1,111	1,671	941	1,524	510	1,414	533
Net long term debt	6,355	6,345	6,065	5,847	5,583	4,798	4,702	4,499
Current liabilities								
Current portion of LtD	1,308	1,111	1,671	941	1,524	510	1,414	533
Accounts payable	429	439	450	532	473	556	497	630
Total liabilities	1,737	1,550	2,122	1,473	1,998	1,066	1,911	1,163
Other liabilities	636	5	794	3	978	501	1,198	375
TOTAL EQUITY AND LIABILITIES	13,999	12,570	15,238	12,566	16,057	12,584	16,546	13,022
Current ratio (times)								
With current LT debt	0.45	0.48	0.43	0.49	0.51	0.80	0.60	0.93
Without	1.62	1.68	2.01	1.37	2.16	1.53	2.32	1.72
Debt of Debt+Equity (%)								
With reval. reserve	57	63	62	58	47	47	39	43
Without	75	63	75	59	72	51	66	47
Net Fx ast/debt (times)	1.71	1.60	1.91	1.62	2.11	1.84	2.45	1.98
Accts. receivable (days)	28	28	28	28	28	28	28	28

/a Including investments in other subsidiaries, which is assumed constant in the projections and would become from about 2.5% in 1984 to less than 1% of KEPCO's total net fixed assets by 1991.

ANNEX III
Table 3

PROJECT COMPLETION REPORT

KOREA

SECOND POWER PROJECT
(LOAN 2671-KO)

Funds Flow Statements
(Billion Won)

Fiscal Year	1986 Plan	1986 Actual	1987 Plan	1987 Actual	1988 Plan	1988 Actual	1989 Plan	1989 Actual
SOURCES OF FUNDS								
Internal generation								
Net income before interest	655	765	672	908	889	1,227	1,246	1,040
Depreciation	973	1,111	1,189	1,318	1,378	1,198	1,465	1,167
Consumers contribution	80	71	78	85	91	106	103	80
Total internal generation	1,708	1,947	1,939	2,311	2,358	2,531	2,814	2,287
External borrowings								
Total borrowings	1,723	812	1,382	1,394	1,043	507	533	318
Changes in other ast/liab.	253	589	296	564	318	295	255	478
TOTAL SOURCES	3,685	3,348	3,617	4,269	3,719	3,333	3,602	3,083
APPLICATIONS OF FUNDS								
Capital expenditures								
Construction expenditure (Including IDC)	1,952	1,457	1,606	1,324	1,328	1,266	1,369	1,434
Total capital expenditures	1,952	1,457	1,606	1,324	1,328	1,266	1,369	1,434
Debt services								
Debt repayment	1,166	1,131	1,308	1,111	1,671	924	1,524	507
Interest	513	442	597	427	627	335	604	274
Total debt services	1,680	1,573	1,906	1,538	2,298	1,259	2,129	781
Prepayment		133		1,280		590		270
Changes in working capital	52	185	105	127	92	218	104	598
TOTAL APPLICATIONS	3,685	3,348	3,617	4,269	3,719	3,333	3,602	3,083
Interest coverage ratio (times)	1.3	1.7	1.1	2.1	1.4	3.7	2.1	3.8
Annual debt services coverage ratio (times)	1.0	1.2	1.0	1.5	1.0	2.0	1.3	2.9
Self-financing ratio (%)								
Annual	-0.14	9.61	-1.01	45.47	.00	88.70	44.96	77.34
3-year ave. (w W/C less cash)	-0.15	9.44	-0.99	44.63	.00	83.74	41.14	69.88
w/o W/C	1.55	25.22	2.05	57.30	4.17	94.85	45.78	94.90
Total capital expenditures: 3-year averages (previous+current+following)	1,803	1,483	1,628	1,349	1,434	1,341	1,498	1,587

/a (total internal sources less debt service and increase in working capital excluding cash) x 100 and divided by average of 3 years (previous, current and following) capital expenditures.

Working Papers on
Internal Rate of Return Calculations

1. Exchange Rate and Price Index

year	Exchange Rate (₩/US$)	Wholesale Price Index					
		Korea, Rep. of		U.S.A.		France	
		Index	Factor	Index	Factor	Index	Factor
1978	485	47.3	2.2262	67.8	1.6667	50.3	2.4215
1979	485	56.1	1.8770	73.6	1.5353	57.0	2.1368
1980	610	78.0	1.3500	87.1	1.2974	62.0	1.9645
1981	683	93.9	1.1214	95.0	1.1895	68.8	1.7703
1982	733	98.2	1.0723	96.9	1.1662	76.4	1.5942
1983	778	98.4	1.0701	98.1	1.1519	84.9	1.4346
1984	808	99.1	1.0626	100.5	1.1244	96.1	1.2674
1985	873	100.0	1.0530	100.0	1.1300	100.0	1.2180
1986	884	98.5	1.0690	97.1	1.1637	91.3	1.3341
1987	825	99.0	1.0636	99.6	1.1345	90.1	1.3518
1988	734	101.7	1.0354	103.6	1.0907	102.8	1.1848
1989	674	103.2	1.0203	108.7	1.0396	117.1	1.0401
1990	690(*)	105.3	1.0000	113.0	1.0000	121.8	1.0000
Related		Local Costs		Foreign Costs except KNU#9,10		Foreign Costs for KNU#9,10	

(*) based on KEPCO's Budget

2. Conversion Factors

Conversion factors between the shadow price and the prevailing are equal to 1

3. Acual Investment Costs

3.1 KNU #5&6

(in US$ million)

year	Current Prices				'90 Constant Prices			
	Local	Foreign	Taxes	Total	Local	Foreign	Taxes	Total
1978	20.49	20.12	-	40.61	45.61	33.53	-	79.14
1979	46.39	77.28	0.21	123.88	87.07	118.65	0.39	206.11
1980	59.64	172.15	0.32	232.11	80.51	223.35	0.43	304.29
1981	74.71	238.66	3.20	316.57	83.78	283.89	3.59	371.26
1982	97.98	187.18	15.65	300.81	105.06	218.23	16.78	340.13
1983	108.90	123.76	17.99	250.65	116.53	142.56	19.25	278.34
1984	103.20	73.50	10.09	186.79	109.66	82.64	10.72	203.02
1985	74.25	28.51	10.25	113.01	78.19	32.22-	10.79	121.20
1986	17.87	19.30	3.35	40.52	19.10	22.46-	3.58	45.14
Total	603.43	940.46	61.06	1,604.95	725.51	1,157.59	65.53	1,948.63

* Excluding I.D.C.

3.2 KNU #7&8

(in US$ million)

year	Current Prices				'90 Constant Prices			
	Local	Foreign	Taxes	Total	Local	Foreign	Taxes	Total
1979	14.80	3.79	-	18.59	27.78	5.82	-	33.60
1980	25.54	22.77	-	48.31	34.48	29.54	-	64.02
1981	60.29	97.05	1.05	158.39	67.61	115.44	1.18	184.23
1982	101.77	201.48	2.41	305.66	109.13	234.97	2.58	346.68
1983	136.22	250.78	11.60	398.60	145.77	288.87	12.41	447.05
1984	142.49	130.01	23.83	296.33	151.41	146.18	25.32	322.91
1985	147.75	93.58	28.27	269.60	155.58	105.75	29.77	291.10
1986	94.80	54.32	16.96	166.08	101.34	63.21	18.13	182.68
1987	42.89	17.60	1.31	61.80	45.62	19.97	1.39	66.98
Total	766.55	871.38	85.43	1,723.36	838.72	1,009.75	90.78	1,939.25

* Excluding I.D.C.

3.3 KNU #9&10 (in US$ million)

year	Current Prices				'90 Constant Prices			
	Local	Foreign	Taxes	Total	Local	Foreign	Taxes	Total
1980	9.03	-	-	9.03	12.19	-	-	12.19
1981	21.79	28.91	-	50.70	24.44	51.18	-	75.62
1982	29.64	98.84	-	128.84	31.78	157.57	-	189.35
1983	52.44	128.42	0.05	180.91	56.12	184.23	0.05	240.40
1984	91.44	214.33	1.68	307.45	97.16	271.64	1.79	370.59
1985	124.79	170.37	11.76	306.92	131.40	207.51	12.38	351.29
1986	130.12	109.61	31.69	271.42	139.10	146.23	33.88	319.21
1987	104.26	62.54	20.96	187.76	110.89	84.54	22.29	217.72
1988	117.53	49.67	14.96	182.16	121.69	58.85	15.49	196.03
1989	117.75	44.85	5.84	168.44	120.14	46.45	5.96	172.75
Total	798.79	907.54	86.94	1,793.27	844.91	1,208.40	91.84	2,145.15

* Excluding I.D.C.

3.4 Transmission & Distribution

(in US$ million)

Classification		Current Prices				'90 Constant Prices			
		'86	'87	'88	'89	'86	'87	'88	'89
Trans.	Foreign	97.13	102.93	121.66	151.45	113.03	116.77	132.69	157.45
	Local	170.13	183.58	158.02	193.46	181.87	195.26	163.61	197.39
	Taxes	18.46	17.5	18.25	16.65	19.73	18.61	18.90	16.99
	Total(*)	273.77	304.01	297.93	361.56	314.63	330.64	315.20	371.83
	I.D.C.	1.51	1.31	0.52	0.22	1.61	1.39	0.54	0.22
Distri.	Foreign	90.73	107.59	139.75	177.63	105.58	122.06	152.43	184.66
	Local	228.07	272.60	376.79	486.01	243.81	289.94	390.13	495.88
	Taxes	17.24	18.29	20.96	19.54	18.43	19.45	21.70	19.94
	Total	336.04	398.48	537.50	683.18	367.82	431.45	564.26	700.48
Multipurpose Hydro Facility Portion	Trans.	-	-	1.11	-	-	-	1.15	-
	Dist.	-	-	-	-	-	-	-	-

(*) Excluded by connecting facilities with Multipurpose Hydro Power Plant

4. Operation & Maintenance Costs

4.1 Generation

(Mills/KWH)

year	Current Prices			'90 Contant Prices		
	KNU#5&6	KNU#7&8	KNU#9&10	KNU#5&6	KNU#7&8	KNU#9&10
1986	4.68 (4.65)	2.06 (2.03)	-	5.01 (4.98)	2.21 (2.18)	-
1987	7.39 (7.36)	4.41 (4.38)	-	7.87 (7.84)	4.69 (4.66)	-
1988	8.26 (8.22)	7.62 (7.58)	1.01 (0.97)	8.54 (8.50)	7.89 (7.85)	1.05 (1.01)
1989	9.18 (9.12)	9.02 (8.96)	7.54 (7.48)	9.38 (9.32)	9.20 (9.14)	7.69 (7.63)
1990 onwards	8.51 (8.45)	7.61 (7.55)	7.17 (7.11)	8.51 (8.45)	7.61 (7.55)	7.17 (7.11)

※ ( ) : Excluding duties & taxes

4.2 Transmission & Distribution

(Mills/KWH)

year	Current Prices			'90 Contant Prices		
	Transmissi	Distributi	Others	Transmissi	Distributi	Others
1986	2.02 (2.01)	4.94 (4.93)	8.37 (4.86)	2.16 (2.15)	5.28 (5.27)	8.95 (5.19)
1987	2.07 (2.05)	5.10 (5.09)	10.07 (6.77)	2.21 (2.19)	5.43 (5.42)	10.71 (7.21)
1988	2.23 (2.21)	5.59 (5.58)	11.28 (7.13)	2.32 (2.30)	5.79 (5.78)	11.68 (7.39)
1989	3.13 (3.11)	6.65 (6.63)	13.81 (7.57)	3.19 (3.17)	6.78 (6.76)	14.09 (7.71)
1990 onwards	3.13 (3.09)	6.83 (6.81)	11.12 (6.98)	3.13 (3.09)	6.83 (6.81)	11.12 (6.98)

※ ( ) : Excluding duties & taxes

5. Fuel Costs

(Mills/KWH)

year	Current Prices			'90 Contant Prices		
	KNU#5&6	KNU#7&8	KNU#9&10	KNU#5&6	KNU#7&8	KNU#9&10
1986	5.41	3.94	-	6.29	4.58	-
1987	5.55	5.01	-	6.30	5.66	-
1988	6.31	5.49	2.92	6.88	5.99	3.17
1989	5.09	5.80	6.48	5.30	6.02	6.74
1990	5.45	5.39	6.58	5.45	5.39	6.58
onwards	5.16	5.13	5.77	5.16	5.13	5.77

6. Revenues

(Mills/KWH)

year	Current Prices			'90 Contant Prices		
	Average Revenues	Sales Taxes	Average Rev. in.Sales Tax	Average Revenues	Sales Taxes	Average Rev. in.Sales Tax
1986	73.01	7.30	80.31	78.05	7.80	85.85
1987	75.33	7.53	82.86	80.12	8.01	88.13
1988	80.59	8.06	88.65	83.44	8.34	91.78
1989	81.90	8.19	90.09	83.56	8.36	91.92
1990	77.26	7.73	84.99	77.26	7.73	84.99
onwards	74.99	7.50	82.49	74.99	7.50	82.49

7. Incremental Energy Sales

year	Net Generation							T & D Loss		Sales
	KNU #5&6		KNU #7&8		KNU #9&10		Total			
	%	GWH	%	GWH	%	GWH	GWH	%	GWH	GWH
1986	-	11,382	-	3,563	-		14,945	5.87	877	14,068
1987	73	11,652	-	11,644	-		23,296	6.01	1,400	21,896
1988	75	12,021	78	12,466	-	2,406	26,893	5.75	1,546	25,347
1989	80	13,309	76	12,139	-	7,259	32,707	6.08	1,989	30,718
1990	77	12,212	75	11,846	71	10,973	35,031	5.83	2,042	32,989
1991	76	12,080	76	12,080	76	12,080	36,240	5.88	2,131	34,109
1992	76	12,113	76	12,113	76	12,113	36,339	6.00	2,180	34,159
1993	76	12,080	76	12,080	76	12,080	36,240	6.00	2,174	34,066
1994	76	12,080	76	12,080	76	12,080	36,240	6.00	2,174	34,066
1995	76	12,080	76	12,080	76	12,080	36,240	6.00	2,174	34,066
1996	77	12,273	77	12,273	77	12,273	36,819	6.00	2,209	34,610
1997	77	12,239	77	12,239	77	12,239	36,717	6.00	2,203	34,514
1998	77	12,239	77	12,239	77	12,239	36,717	6.00	2,203	34,514
1999	77	12,239	77	12,239	77	12,239	36,717	6.00	2,203	34,514
2000	77	12,273	77	12,273	77	12,273	36,819	6.00	2,209	34,610
2001	77	12,239	77	12,239	77	12,239	36,717	6.00	2,203	34,514
2002	78	12,398	78	12,398	78	12,398	37,194	6.00	2,232	34,962
2003	78	12,398	78	12,398	78	12,398	37,194	6.00	2,232	34,962
2004	78	12,432	78	12,432	78	12,432	37,296	6.00	2,238	35,058
2005	78	12,398	78	12,398	78	12,398	37,194	6.00	2,232	34,962
2006	78	12,398	78	12,398	78	12,398	37,194	6.00	2,232	34,962
2007	78	12,398	78	12,398	78	12,398	37,194	6.00	2,232	34,962
2008	78	12,432	78	12,432	78	12,432	37,296	6.00	2,238	35,058
2009	78	12,398	78	12,398	78	12,398	37,194	6.00	2,232	34,962
2010	-	10,836	78	12,398	78	12,398	35,632	6.00	2,138	33,494
2011	-	2,038	-	10,326	78	12,398	24,762	6.00	1,486	23,276
2012		-	-	2,582	78	12,432	15,014	6.00	901	14,113
2013				-	-	10,326	10,326	6.00	620	9,706
2014					-	4,637	4,637	6.00	278	4,359
2015						-	-	-	-	-
Tot		306,637		310,151		306,016	922,804			867,596

* % in generation column : Capacity factors